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By: Ronnie D. East

Signed: 

Date of signature and deposit/transmission: February 20, 2007

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Hong Jiang et al:) Group Art Unit: 3663
Serial No.: 10/774,805)
Filed: February 9, 2004) Confirmation No.: 9249
For: Method and System for Controlling a) Examiner: Pipala, Edward J.
Transfer Case Clutch to Protect Against) Atty. Docket: 81075405
Excessive Heat)
)

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Alexandria, VA 22313-1450

RESPONSE

Honorable Sir:

This is a response to the Notification dated February 15, 2007, regarding the Appeal Brief filed on November 30, 2006. The Appeal Brief enclosed with this response is to be substituted for the Appeal Brief dated November 30, 2006.

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APPEAL BRIEF

Honorable Sir:

This is an appeal from a final rejection of the subject patent application set forth in an Office action dated August 25, 2006.

(i) Real Party in Interest

Ford Motor Company, a Delaware corporation, is the real party in interest.

(ii) Related Appeals and Interferences

The Applicants, and Applicants' legal representative and assignee are unaware of any application, patent, prior or pending appeals, interferences or judicial proceedings that may relate to, directly affect, or be directly affected by or have a bearing on the Board's decision in this appeal.

(iii) Status of Claims

The claims involved in this appeal are claims 1-9 and 17-19. Each of these claims stands rejected. Claims 10-16 and 20-32 are withdrawn. No claims stand objected to.

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(iv) Status of Amendments

No amendments have been filed after the final rejection of August 25, 2006.

(v) Summary of Claimed Subject Matter

Claim 1 defines a method for controlling a clutch assembly 100 (p. 7, ll. 8-25; p. 27, ll. 2-9) including producing input torque at the clutch 100 (p. 27, ll. 11-13); operating the clutch partially engaged (p. 13, ll. 5-11; p. 13, ll. 21-23; p. 20, ll. 13-14; step 186 of Figure 4A); calculating the temperature of the clutch (p. 28, ll. 24- p. 29, ll. 7); establishing a reference clutch temperature and comparing the calculated clutch temperature and reference clutch temperature (p. 29, ll. 9-17). If the calculated clutch temperature equals or exceeds the reference clutch temperature, then the degree of clutch engagement is increased sufficiently to reduce the calculated temperature of the clutch (p. 29, ll.17-24).

The current clutch slip is determined (p. 11, ll.12-14; p. 9, ll. 16-18; p. 13, ll. 21-23). A first desired portion of the input torque to be transmitted by the clutch to the output is established (p. 22, ll. 24-28) and a first magnitude of clutch torque corresponding to the first desired portion is determined (p. 22, ll. 30 - p. 23, ll. 11).

A second magnitude of clutch torque to be transmitted to the output in proportion to the current clutch slip is determining and the magnitude of torque transmitted by the clutch is changed to the sum of the first and second magnitudes (p.20, ll. 14-20).

The step of calculating the temperature of the clutch includes repetitively calculating the change of temperature of the clutch over successive time intervals and maintaining a running total of the change of clutch temperature over each interval (p. 29, ll. 1-7).

The step of repetitively calculating the change of temperature of the clutch, includes the steps of repetitively calculating the differential change in power transmitted by the clutch over successive intervals, determining the thermal mass of the clutch, and dividing the differential change in power transmitted by the clutch over an interval by the thermal mass of the clutch (p. 28, ll. 24-30).

The step of repetitively calculating the differential change in power transmitted by the clutch over a time interval, includes repetitively determining the magnitude of power transmitted to the clutch input over successive intervals (p. 27, ll. 11-13); repetitively determining the magnitude of power transmitted from clutch output over successive intervals (p. 19, ll. 19-22); and repetitively calculating the difference in the magnitude of power at the clutch input and the magnitude of power at the clutch output over each interval (p. 28, ll. 24-26).

The step of repetitively determining the magnitude of power over an interval at the clutch output includes determining the clutch gain (p. 28, ll. 9-15); repetitively determining the magnitude of pressure at the clutch servo at successive intervals (p. 28, ll. 15-17); repetitively determining the speed of the clutch output at successive intervals (p. 28, ll. 20-22); and repetitively calculating the product of clutch gain, speed of the clutch output, and the magnitude of pressure at the clutch servo at each interval (p. 28, ll. 5-7; p. 28, ll. 19-22).

The step of determining the clutch gain includes determining the average coefficient of friction of a friction disc-spacer plate pair located in the clutch (p. 28, ll. 9-12); determining the number of disc-plate pairs in the clutch (p. 28, ll. 12); determining the effective friction area of the disc-spacer pairs (p. 28, ll. 12-13); determining the effective radius of the frictional area of the disc-plate pairs from the axis, about which the clutch rotates (p. 28, ll. 13-14); and calculating the product of said the average coefficient of friction, the number of disc-plate pairs, the effective friction area, and the effective radius (p. 28, ll. 9-15).

The method of claim 1 further includes establishing a threshold clutch temperature that is higher than the reference clutch temperature and comparing the calculated clutch temperature and threshold clutch temperature (p. 29, ll. 9-17). Then, if the calculated clutch temperature equals or exceeds the threshold clutch temperature, the clutch is fully engaged (p. 29, ll. 17-21).

In claim 17, the means for operating the clutch 100 partially engaged are the clutch servo 262, clutch pressure solenoid 256, the source of fluid pressure 258 and controller 170 (p. 10, ll. 6-19). The controller 170 is the means for calculating the temperature of the clutch, establishing a reference clutch temperature, comparing the

calculated temperature of the clutch and reference clutch temperature, and producing an output signal for increasing the degree of clutch engagement sufficiently to reduce the calculated temperature of the clutch, if the calculated temperature of the clutch equals or exceeds the reference clutch temperature (p. 26, ll. 29 - p. 29, ll. 24).

The system of claim 19 includes a fluid pressure source 258; a servo 262 through which the clutch 100 is alternately pressurized and vented to engage and disengage the clutch; and a solenoid 256 communicating with the controller 170 for increasing a magnitude of pressure in the servo 262 in responsive an output signal (p. 26, ll. 29 - p. 29, ll. 24).

(vi) Grounds of Rejection to be Reviewed on Appeal

1. Whether claim 1 is unpatentable under 35 U.S.C. 102(b) as anticipated by U. S. Patent 6,095,946 of Maguire et al. (the '946 patent).
2. Whether claim 17 is unpatentable under 35 U.S.C. 102(b) as anticipated by U. S. Patent 6,095,946 of Maguire et al. (the '946 patent).
3. Whether claim 18 is unpatentable under 35 U.S.C. 102(b) as anticipated by U. S. Patent 6,095,946 of Maguire et al. (the '946 patent).
4. Whether claim 19 is unpatentable under 35 U.S.C. 102(b) as anticipated by U. S. Patent 6,095,946 of Maguire et al. (the '946 patent).
5. Whether claim 1 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).
6. Whether claim 2 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).
7. Whether claim 3 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).
8. Whether claim 4 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).
9. Whether claim 6 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).
10. Whether claim 7 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).

11. Whether claim 8 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).

12. Whether claim 9 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).

13. Whether claim 17 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).

14. Whether claim 18 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).

15. Whether claim 19 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).

(vii) Argument

The final rejection contains the following errors: (1) limitations of claims 1 and 17-19 are not disclosed in the '946 patent of Maguire et al., which is cited as a prior art reference for rejecting those claims under 35 U.S.C. 102(b), and (2) limitations of claims 1-9 and 17-19 are neither disclosed, taught, nor suggested in the '149 patent or the '946 patent, which are cited as prior art reference basis for rejecting those claims under 35 U.S.C. 103(a).

1. Whether claim 1 is unpatentable under 35 U.S.C. 102(b) as anticipated by U. S. Patent 6,095,946 of Maguire et al. (the '946 patent).

Claim 1 of the subject application recites a method for controlling a clutch. The method steps include operating the clutch partially engaged; calculating the temperature of the clutch; comparing the calculated clutch temperature and a reference clutch temperature; and, if the calculated clutch temperature equals or exceeds the reference clutch temperature, then increasing the degree of clutch engagement sufficiently to reduce the calculated temperature of the clutch.

With respect to Claim 1, the prosecution record indicates that the patent examiner relies on col. 3, ll. 12-21, col. 4, ll. 3-29, and Figures 2 and 3 of the '946 patent for disclosing an increase in the degree of clutch engagement.

Column 3, lines 12-21 of the '946 patent says that the friction discs of the clutch are heated during engagement and are cooled by fluid flow after engagement or while disengaged. The steel discs provide a heat sink for absorbing heat energy where that heat is transferred to the hydraulic fluid and surrounding metal components. The cited text and the entire '946 patent are silent with respect to changing the degree of clutch engagement.

Column 4, lines 3-29 of the '946 patent discusses measuring temperatures using heat sensors or calculating the temperature of the friction devices. If a transmission gearshift is requested, certain information is read into step 38. Further, it says the computer uses the data in step 38 to calculate the energy transmitted during a shift, passes control to step 42 where a temperature differential expected during the shift is calculated. The required heat sink is determined in step 44. The algorithm determines the torque capacity required to complete the ratio change, and the heat sink required to absorb the heat that will be generated during the ratio change. From this it can be seen that the cited text is entirely silent with respect to changing the degree of clutch engagement.

Figure 2 of the '946 patent shows in graphical form the steps described in the cited portion of column 4. There is no disclosure respecting Figure 2 of increasing the degree of clutch engagement to reduce clutch temperature, as claim 1 of the present application defines the method and system.

Similarly, Figure 3 is silent with respect to changing the degree of clutch engagement. Instead, Figure 3 and the '946 patent disclose that if the temperature produced during the shift will exceed a design limit, at step 52, adaptive values including shift time, engine spark timing, and fuel feed are established such that the energy absorbed during the ratio changes does not result in a temperature increase above the design limit. (See col. 4, lines 31-42).

Therefore, instead of disclosing an increase the degree of clutch engagement to avoid overheating the clutch, the '946 patent discloses the technique of

changing engine output energy during a speed ratio change in the transmission 20. The time for the shift, engine spark timing and engine fuel feed are changed to change the amount of energy produce by the engine and transmitted through clutch 18 during the shift. This is an entirely different technique than that recited in Claim 1 and 17. There, if the calculated clutch temperature equals or exceeds their reference clutch temperature, the degree of slip across the clutch is decreased by increasing the degree of clutch engagement, thereby reducing the temperature of the clutch. The '946 patent is silent with respect to this technique and teaches a different technique for avoiding clutch heating.

The '946 contains no disclosure that the current clutch temperature and a reference clutch temperature are compared mutually. Instead, the '946 patent discloses that the current clutch temperature is calculated, a temperature increase in the clutch due to the next shift of the transmission is calculated, and the expected temperature of the clutch at the end of the next shift is calculated (col. 4, ll. 23-30).

The '946 patent discloses that if the future clutch temperature will exceed the design limit after the next shift of the transmission, then at step 52, an algorithm determines the length of time to make the shift, engine spark timing, and fuel feed that should be established such that the clutch temperature will not be excessive. Then at step 54, those values of time to make the shift, engine spark timing, and fuel feed are passed to the main program to be used for the subject shift only. (col. 4, ll. 35-42)

The '946 contains no disclosure that the degree of clutch engagement is increased sufficiently to reduce the calculated temperature of the clutch, as claim 1 recites. Instead, the '946 patent discloses that the steps taken to avoid excessive clutch temperature are changing engine output , i.e., the magnitude of energy transmitted from the engine and through the clutch during the next shift, by adjusting engine spark timing and engine fuel feed.

2. Whether claim 17 is unpatentable under 35 U.S.C. 102(b) as anticipated by U. S. Patent 6,095,946 of Maguire et al. (the '946 patent).

Claim 17 of the subject application recites a system for controlling a clutch in a transfer case. The '946 patent discloses no transfer case. Instead, its Figure 1 discloses an engine 12, a transmission 14 having a planetary gear arrangement 20, and a clutch 18, which driveably connects the engine shaft and the transmission input.

Similarly as discussed with respect to claim 1 above, claim 17 recites operating the clutch partially engaged; comparing the calculated temperature of the clutch and reference clutch temperature; and producing an output signal for increasing the degree of clutch engagement sufficiently to reduce the calculated temperature of the clutch, if the calculated temperature of the clutch equals or exceeds the reference clutch temperature. Those elements of claim 17 are entirely absent from the '946 patent.

Figure 2 of the '946 patent shows in graphical form the steps described in the cited portion of column 4. There is no disclosure in Figure 2 of increasing the degree of clutch engagement to reduce clutch temperature, as claim 17 of the present application defines the system.

Similarly, Figure 3 is silent with respect to changing the degree of clutch engagement. Instead, Figure 3 and the '946 patent disclose that if the temperature produced during the shift will exceed a design limit, at step 52, adaptive values including shift time, engine spark timing, and fuel feed are established such that the energy absorbed during the ratio changes does not result in a temperature increase above the design limit. (See col. 4, lines 31-42).

Therefore, instead of disclosing an increase the degree of clutch engagement to avoid overheating the clutch, the '946 patent discloses the technique of changing engine output energy during a speed ratio change in the transmission 20. The time for the shift, engine spark timing and engine fuel feed are changed to reduce the amount of energy produce by the engine and transmitted through clutch 18 during the shift. This is an entirely different technique than that recited in Claim 1. There, if the calculated clutch temperature equals or exceeds their reference clutch temperature, the degree of slip across the clutch is decreased by increasing the degree of clutch engagement, thereby reducing the temperature of the clutch. The '946 patent is silent

with respect to this technique, and it teaches a different technique for avoiding clutch heating.

The '946 contains no disclosure that the current clutch temperature and a reference clutch temperature are compared mutually. Instead, the '946 patent discloses that the current clutch temperature is calculated, a temperature increase in the clutch due to the next shift of the transmission is calculated, and the expected temperature of the clutch at the end of the next shift is calculated (col. 4, ll. 23-30).

The '946 patent discloses that if the future clutch temperature will exceed the design limit after the next shift of the transmission, then at step 52, an algorithm determines the length of time to make the shift, engine spark timing, and fuel feed that should be established such that the clutch temperature will not be excessive. Then at step 54, those values of time to make the shift, engine spark timing, and fuel feed are passed to the main program to be used for the subject shift only. (col. 4, ll. 35-42)

The '946 contains no disclosure that the degree of clutch engagement is increased sufficiently to reduce the calculated temperature of the clutch, as claim 1 recites. Instead, the '946 patent discloses that the steps taken to avoid excessive clutch temperature are reducing engine output, i.e., the magnitude of energy transmitted from the engine and through the clutch during the next shift, by adjusting engine spark timing and engine fuel feed.

3. Whether claim 18 is unpatentable under 35 U.S.C. 102(b) as anticipated by U. S. Patent 6,095,946 of Maguire et al. (the '946 patent).

Claim 18 adds to the system of claim 17 the following limitation:

wherein the output signal producing means fully engages the clutch if the calculated temperature of the clutch equals or exceeds the reference clutch temperature.

The '946 patent contains no disclosure that its clutch 18 is engaged if the calculated temperature of the clutch equals or exceeds a reference clutch temperature.

With respect to Claims 18 and 19, the prosecution record indicates that the patent examiner relies a fourth portion of the '946 patent (specifically, col. 3, lines 54-62) for the subject rejection. In the cited text, the '946 patent discloses a technique, whereby the CPU controls engine output energy, engagement time of the friction devices, and the rate of pressure change in the friction devices during the engagement to avoid overheating the clutch. This section is entirely silent with respect to decreasing clutch slip or increasing the degree of engagement of the clutch, as recited in Claims 1 and 17, from which Claims 18 and 19 depend.

4. Whether claim 19 is unpatentable under 35 U.S.C. 102(b) as anticipated by U. S. Patent 6,095,946 of Maguire et al. (the '946 patent).

Claim 19 adds to the system of claim 17 the following elements:

a fluid pressure source;
a servo through which the clutch is alternately pressurized and vented to engage and disengage the clutch; and
a solenoid communicating with the output producing means for increasing a magnitude of pressure in the servo in responsive to the output signal.

The '946 patent discloses none of the elements of claim 19.

5. Whether claim 1 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Saleckcr et al. (the '149 patent).

Claims 1-9 stand rejected under 35 USC 103(a) as unpatentable over the '149 patent in view of the '946 patent.

Regarding claim 1 and the rejection under 35 USC 103(a), the subject Office action acknowledges that the '149 patent does not teach "increasing the degree of clutch engagement sufficiently to reduce the calculated temperature of the clutch." The prosecution clearly shows that the patent examiner relies on the '946 patent disclosing (col. 3, lines 12-21) "completely engaging or completely disengaging the clutch discs to avoid heating the clutch system." The cited portion of column 3 is entirely silent with respect to this topic, as discussed above.

The prosecution record indicates that the patent examiner believes that the '946 patent discloses (at col. 4, ll. 23-29) that the transmission control is accomplished by keeping track of the temperature increase and mitigating any additional heating when the clutch temperature reaches or exceeds the desired clutch temperature limit, as shown in Figure 4. The cited section of the '946 patent neither discloses nor suggests increasing the degree of clutch engagement to avoid overheating the clutch 18.

The '946 patent describes a technique for reducing engine output energy instead of increasing the degree of clutch engagement or reducing slip across the clutch, as recited in the claims of the present application. The subject Office action correctly acknowledges that the '149 patent does not disclose "increasing the degree of clutch engagement sufficiently to reduce the calculated temperature of the clutch" when the calculated clutch temperature equals or exceeds the reference clutch temperature. The '149 patent teaches no remedy for dealing with excessive clutch temperature. Instead, upon the vehicle operator turning off the engine ignition system, a certain parameter P is saved in electronic memory, such as the calculated clutch temperature. If the saved parameter P is less than a reference value, the value of P is stored electronically and the control unit is deactivated. If the saved parameter P is greater than a reference value, the value of P is determined at a later time. (col. 13, ll. 39-59; step 401, Fig. 8; and steps 403-408, Fig. 8)

There is no suggest or reason or motivation for combining the disclosures of the '946 patent and the '149 patent, none is mentioned in the subject Office action,

and none appears explicitly or implicitly in the '946 patent or the '149 patent. The '149 patent is concerned with calculating a clutch temperature, turning off the engine ignition system, and deactivated a control unit. There is no remedial action disclosed in the '149 patent for reducing the clutch temperature while continuing to operate the engine. The '149 patent is concerned with calculating the clutch temperature.

As discussed above with reference to claim 1, the '946 contains no disclosure that the degree of clutch engagement is increased sufficiently to reduce the calculated temperature of the clutch. The '946 patent discloses that if the future clutch temperature will exceed a reference clutch temperature after the next shift of the transmission, then remedial steps are taken.

Figure 2 of the '946 patent shows in graphical form the steps described in the cited portion of column 4. There is no disclosure in Figure 2 of increasing the degree of clutch engagement to reduce clutch temperature, as claim 1 of the present application defines the method and system.

Similarly, Figure 3 is silent with respect to changing the degree of clutch engagement. Instead, Figure 3 and the '946 patent disclose that if the temperature produced during the shift will exceed a design limit, at step 52, adaptive values including shift time, engine spark timing, and fuel feed are established such that the energy absorbed during the ratio changes does not result in a temperature increase above the design limit. (See col. 4, lines 31-42).

Therefore, instead of disclosing an increase the degree of clutch engagement to avoid overheating the clutch, the '946 patent discloses the technique of reducing engine output energy during a speed ratio change in the transmission 20. The time for the shift, engine spark timing and engine fuel feed are changed to reduce the amount of energy produce by the engine and transmitted through clutch 18 during the shift. This is an entirely different technique than that recited in Claim 1. There, if the calculated clutch temperature equals or exceeds their reference clutch temperature, the degree of slip across the clutch is decreased by increasing the degree of clutch engagement, thereby reducing the temperature of the clutch. The '946 patent is silent with respect to this technique and teaches a different technique for avoiding clutch heating.

The '946 contains no disclosure that the current clutch temperature and a reference clutch temperature are compared mutually. Instead, the '946 patent discloses that the current clutch temperature is calculated, a temperature increase in the clutch due to the next shift of the transmission is calculated, and the expected temperature of the clutch at the end of the next shift is calculated (col. 4, ll. 23-30).

The '946 patent discloses that if the future clutch temperature will exceed the design limit after the next shift of the transmission, then at step 52, an algorithm determines the length of time to make the shift, engine spark timing, and fuel feed that should be established such that the clutch temperature will not be excessive. Then at step 54, those values of time to make the shift, engine spark timing, and fuel feed are passed to the main program to be used for the subject shift only. (col. 4, ll. 35-42)

The '946 contains no disclosure that the degree of clutch engagement is increased sufficiently to reduce the calculated temperature of the clutch, as claim 1 recites. Instead, the '946 patent discloses that the steps taken to avoid excessive clutch temperature are reducing engine output, i.e., the magnitude of energy transmitted from the engine and through the clutch during the next shift, by adjusting engine spark timing and engine fuel feed.

The '946 patent does not disclose or suggest that a step taken to avoid excessive clutch temperature is increasing the degree of clutch engagement. Instead, the strategy of the '946 patent would reduce engine torque by adjusting engine spark timing and engine fuel feed, and increase apply pressure at the clutch.

6. Whether claim 2 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).

The method steps of claim 2 for operating the clutch partially engaged by determining the current clutch slip; establishing a first desired portion of the input torque to be transmitted by the clutch to the output; determining a first magnitude of clutch torque corresponding to the first desired portion; determining a second

magnitude of clutch torque to be transmitted to the output in proportion to the current clutch slip; and changing the magnitude of torque transmitted by the clutch to the sum of the first and second magnitudes are neither disclosed, taught or suggested by either the '946 patent or the '149 patent nor does the patent examiner indicate that the elements of claim 2 are present in any cited prior art references.

The Office action says that the '149 patent (col.8, ll. 49-67 and col. 9, ll. 25-35) teaches "clutch slip adjustment for torque transmission while limiting excessive clutch slip." The cited reference to col.8, ll. 49-67 discusses a master cylinder, slave cylinder and electric motor, none of which is relevant to claim 2. The cited reference to col. 9, ll. 25-35 refers obliquely to determining stress on a torque transmitting system due to excessive clutch slip, and initiating "undertakings" to prevent excessive stressing, without describing or suggesting the steps undertaken.

There is no suggestion or reason or motivation for combining the disclosures of the '946 patent and the '149 patent, none is mentioned in the subject Office action, and none appears explicitly or implicitly in the '946 patent or the '149 patent.

7. Whether claim 3 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).

The method step of claim 3 for increasing the degree of clutch engagement over a period sufficient to reduce the calculated temperature of the clutch includes the step of fully engaging the clutch is neither disclosed, taught or suggested by either the '946 patent or the '149 patent nor does the patent examiner indicate that the elements of claim 3 are present in any cited prior art references.

The Office action says that the '149 patent (col.8, ll. 49-67 and col. 9, ll. 25-35) teaches "clutch slip adjustment for torque transmission while limiting excessive clutch slip." The cited reference to col.8, ll. 49-67 discusses a master cylinder, slave cylinder and electric motor, none of which is relevant to claim 3. The cited reference to col. 9, ll. 25-35 refers obliquely to determining stress on a torque transmitting system due to excessive clutch slip, and initiating "undertakings" to prevent excessive stressing, without describing or suggesting the steps undertaken. Neither of these citations is relevant to claim 3.

There is no suggestion or reason or motivation for combining the disclosures of the '946 patent and the '149 patent, none is mentioned in the subject Office action, and none appears explicitly or implicitly in the '946 patent or the '149 patent.

8. Whether claim 4 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).

Claim 4 says that the step of calculating the temperature of the clutch, includes the steps of repetitively calculating the change of temperature of the clutch over successive time intervals; and maintaining a running total of the change of clutch temperature over each interval.

The elements of claim 4 incorporate by reference the steps recited in claim 1. As discussed in Section (vii) 5., the steps of claim 1 are neither disclosed, taught or suggested by either the '946 patent or the '149 patent.

There is no suggestion or reason or motivation for combining the disclosures of the '946 patent and the '149 patent, none is mentioned in the subject Office action, and none appears explicitly or implicitly in the '946 patent or the '149 patent.

9. Whether claim 6 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).

Claim 6 recites that the step of repetitively calculating the differential change in power transmitted by the clutch over a time interval includes repetitively determining the magnitude of power transmitted to the clutch input over successive intervals; repetitively determining the magnitude of power transmitted from clutch output over successive intervals; and repetitively calculating of the difference in the magnitude of power at the clutch input and the magnitude of power at the clutch output over each interval.

In rejecting claim 6, the subject Office action merely refers to Figures 2 and 3 of the '946 patent, without any further discussion of their relevance.

Figure 2 of the '946 patent shows in graphical form the steps described in the cited portion of its column 4. Figure 3 and the '946 patent disclose that if the temperature produced during the shift will exceed a design limit, at step 52, adaptive values including shift time, engine spark timing, and fuel feed are established such that the energy absorbed during the ratio changes does not result in a temperature increase above the design limit. (See col. 4, lines 31-42).

There is no disclosure in Figure 2 or Figure 3 of determining the magnitude of power transmitted to the clutch input over successive intervals, or repetitively determining the magnitude of power transmitted from clutch output over successive intervals, or repetitively calculating of the difference in the magnitude of power at the clutch input and the magnitude of power at the clutch output over each interval.

There is no suggestion or reason or motivation for combining the disclosures of the '946 patent and the '149 patent, none is mentioned in the subject Office action, and none appears explicitly or implicitly in the '946 patent or the '149 patent.

10. Whether claim 7 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).

Claim 7 recites that the step of repetitively determining the magnitude of power over an interval at the clutch output includes determining the clutch gain,

repetitively determining the magnitude of pressure at the clutch servo at successive intervals, repetitively determining the speed of the clutch output at successive intervals, and repetitively calculating the product of clutch gain, speed of the clutch output, and the magnitude of pressure at the clutch servo at each interval.

In rejecting claim 7, the subject Office action refers to Figure 2, col. 1, ll.14-33, and col.3 of the '946 patent, without any further discussion of their relevance. The strategy of the '946 patent adjusts engine output if the temperature due to next transmission shift would increase clutch temperature above a limit temperature. Changing clutch slip is not part of the strategy of the '946 patent although determining clutch gain is employed.

Neither the '946 patent nor the '149 patent teach, or suggest repetitively determining the magnitude of pressure at the clutch servo at successive intervals, repetitively determining the speed of the clutch output at successive intervals, and repetitively calculating the product of clutch gain, speed of the clutch output, and the magnitude of pressure at the clutch servo at each interval.

There is no suggestion or reason or motivation for combining the disclosures of the '946 patent and the '149 patent, none is mentioned in the subject Office action, and none appears explicitly or implicitly in the '946 patent or the '149 patent.

11. Whether claim 8 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).

Claim 8 recites that the step of determining the clutch gain, includes the steps of determining the average coefficient of friction of a friction disc-spacer plate pair located in the clutch; determining the number of disc-plate pairs in the clutch; determining the effective friction area of the disc-spacer pairs; determining the effective radius of the frictional area of the disc-plate pairs from the axis about which the clutch rotates; and calculating the product of said the average coefficient of friction, said number of disc-plate pairs, said effective friction area, and said effective radius.

In rejecting claim 8, the subject Office action refers to Figure 2, col. 1, ll.14-33, and col.3 of the '946 patent, without any further discussion of their relevance. The strategy of the '946 patent adjusts engine output if the temperature due to next transmission shift would increase clutch temperature above a limit temperature. Changing clutch slip is not part of the strategy of the '946 patent although determining clutch gain is employed but the step recited in claim 8 for determining clutch gain are not disclosed or suggested in the cited references from the prior art.

Claim 8 incorporates by reference the steps recited in claim 1. As discussed in Section (vii) 5., the steps of claim 1 are neither disclosed, taught or suggested by either the '946 patent or the '149 patent.

There is no suggestion or reason or motivation for combining the disclosures of the '946 patent and the '149 patent, none is mentioned in the subject Office action, and none appears explicitly or implicitly in the '946 patent or the '149 patent.

12. Whether claim 9 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).

Claim 9 recites the following steps: establishing a threshold clutch temperature that is higher than the reference clutch temperature, comparing the calculated clutch temperature and threshold clutch temperature, and, if the calculated clutch temperature equals or exceeds the threshold clutch temperature, then fully engaging the clutch.

In rejecting claim 9, the subject Office action concludes that claim 9 would have been obvious to one of ordinary skill in the art "to fully engage the clutch" upon determining that the clutch temperature is higher than a reference temperature. The examiner provides no reference to the prior art or any other basis for this conclusion.

Claim 9 should not have been rejected under 35 USC 103(a) as unpatentable over the '149 patent in view of the '946 patent when no reference to

these prior art patents is made to support the rejection. Claim 9 should not have been rejected under 35 USC 103(a) without providing support for the rejection.

There is no suggestion or reason or motivation for combining the disclosures of the '946 patent and the '149 patent, none is mentioned in the subject Office action, and none appears explicitly or implicitly in the '946 patent or the '149 patent.

13. Whether claim 17 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).

Claim 17 stands rejected under 35 USC 103(a) as unpatentable over the '149 patent in view of the '946 patent. But the subject Office action provides no reference to those patents or any other reference in support of the rejection of claim 17 under 35 USC 103(a). There is no suggest or reason or motivation for combining the disclosures of the '946 patent and the '149 patent, none is mentioned in the subject Office action, and none appears explicitly or implicitly in the '946 patent or the '149 patent.

Claim 17 should not have been rejected under 35 USC 103(a) as unpatentable over the '149 patent in view of the '946 patent when no reference to these prior art patents is made to support the rejection. Applicant cannot be expected to guess as to the basis for rejecting claim 17.

Claim 17 recites a system for controlling a clutch in a transfer case. Neither the '946 patent nor the '149 disclose a transfer case. Figure 1, 2 and 10 of the '149 disclose a start-up clutch in a torque deliver path between an engine output and a transmission input. The clutch does not transmit torque between a transmission output and a secondary pair of vehicle wheels, as does the transfer clutch in a transfer case (see Figs. 1, 2A, and 2B of the subject application).

Similarly as discussed above with respect to claim 1, claim 17 recites producing an output signal for increasing the degree of clutch engagement sufficiently to reduce the calculated temperature of the clutch, if the calculated temperature of the

clutch equals or exceeds the reference clutch temperature. Those limitations of claim 17 are absent from the '946 patent and '149 patent.

Combining the disclosures of the '946 patent and '149 patent neither teaches, discloses nor suggests the method or system defined by claims 1-9 and 17-19 of the subject application. Claims 1-9 and 17-19 should not be rejected as obvious in view of these prior art references.

14. Whether claim 18 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).

Claim 18 stands rejected under 35 USC 103(a) as unpatentable over the '149 patent in view of the '946 patent. But the subject Office action provides no reference to those patents or any other reference in support of the rejection of claim 18 under 35 USC 103(a). There is no suggest or reason or motivation for combining the disclosures of the '946 patent and the '149 patent, none is mentioned in the subject Office action, and none appears explicitly or implicitly in the '946 patent or the '149 patent.

Claim 18 should not have been rejected under 35 USC 103(a) as unpatentable over the '149 patent in view of the '946 patent when no reference to these prior art patents is made to support the rejection. Applicant cannot be expected to guess as to the basis for rejecting claim 18.

Claim 18 depends from claim 17 and recites that the output signal producing means fully engages the clutch if the calculated temperature of the clutch equals or exceeds the reference clutch temperature. Neither the '946 patent, the '149 patent nor any other reference disclose fully engaging the clutch if the calculated temperature of the clutch equals or exceeds the reference clutch temperature.

Combining the disclosures of the '946 patent and '149 patent neither teaches, discloses nor suggests the method or system defined by claims 1-9 and 17-19 of the subject application. Claims 1-9 and 17-19 should not be rejected as obvious in view of these prior art references.

15. Whether claim 19 is unpatentable under 35 U.S.C. 103(a) over U. S. Patent 6,006,149 of Salecker et al. (the '149 patent).

Claim 19 stands rejected under 35 USC 103(a) as unpatentable over the '149 patent in view of the '946 patent. But the subject Office action provides no reference to those patents or any other reference in support of the rejection of claim 19 under 35 USC 103(a). There is no suggest or reason or motivation for combining the disclosures of the '946 patent and the '149 patent, none is mentioned in the subject Office action, and none appears explicitly or implicitly in the '946 patent or the '149 patent.

Claim 19 depends from claim 17 and further includes a fluid pressure source; a servo through which the clutch is alternately pressurized and vented to engage and disengage the clutch; and a solenoid communicating with the output producing means for increasing a magnitude of pressure in the servo in responsive the output signal. Neither the '946 patent, the '149 patent nor any other reference disclose the servo and solenoid recited in claim 19. Claim 19 should not have been rejected under 35 USC 103(a) as unpatentable over the '149 patent in view of the '946 patent when no reference to these prior art patents is made to support the rejection. Applicant cannot be expected to guess as to the basis for rejecting claim 19.

Combining the disclosures of the '946 patent and '149 patent neither teaches, discloses nor suggests the method or system defined by claims 1-9 and 17-19 of the subject application. Claims 1-9 and 17-19 should not be rejected as obvious in view of these prior art references.

(viii) Claims Appendix

1. A method for controlling a clutch that driveably connects an input and an output, the method comprising the steps of:
 - producing input torque at the clutch;
 - operating the clutch partially engaged;
 - calculating the temperature of the clutch;

establishing a reference clutch temperature;
comparing the calculated clutch temperature and reference clutch temperature;
and
if the calculated clutch temperature equals or exceeds the reference clutch temperature, then increasing the degree of clutch engagement sufficiently to reduce the calculated temperature of the clutch.

2. The method of claim 1, wherein the step of operating the clutch in a partially engaged condition includes the steps of:
 - determining the current clutch slip;
 - establishing a first desired portion of the input torque to be transmitted by the clutch to the output;
 - determining a first magnitude of clutch torque corresponding to the first desired portion;
 - determining a second magnitude of clutch torque to be transmitted to the output in proportion to the current clutch slip; and
 - changing the magnitude of torque transmitted by the clutch to the sum of the first and second magnitudes.
3. The method of claim 1, wherein the step of then increasing the degree of clutch engagement over a period sufficient to reduce the calculated temperature of the clutch includes the step of fully engaging the clutch.
4. The method of claim 1, wherein the step of calculating the temperature of the clutch, includes the steps of:
 - repetitively calculating the change of temperature of the clutch over successive time intervals; and
 - maintaining a running total of the change of clutch temperature over each interval.
5. The method of claim 4, wherein the step of repetitively calculating the change of temperature of the clutch, includes the steps of:

repetitively calculating the differential change in power transmitted by the clutch over successive intervals;

determining the thermal mass of the clutch; and

dividing the differential change in power transmitted by the clutch over an interval by the thermal mass of the clutch.

6. The method of claim 5, wherein the step of repetitively calculating the differential change in power transmitted by the clutch over a time interval, includes the steps of:

repetitively determining the magnitude of power transmitted to the clutch input over successive intervals;

repetitively determining the magnitude of power transmitted from clutch output over successive intervals; and

repetitively calculating of the difference in the magnitude of power at the clutch input and the magnitude of power at the clutch output over each interval.

7. The method of claim 6, wherein the step of repetitively determining the magnitude of power over an interval at the clutch output, includes the steps of:

determining the clutch gain;

repetitively determining the magnitude of pressure at the clutch servo at successive intervals;

repetitively determining the speed of the clutch output at successive intervals; and

repetitively calculating the product of clutch gain, speed of the clutch output, and the magnitude of pressure at the clutch servo at each interval.

8. The method of claim 7, wherein the step of determining the clutch gain, includes the steps of:

determining the average coefficient of friction of a friction disc-spacer plate pair located in the clutch;

determining the number of disc-plate pairs in the clutch;

determining the effective friction area of the disc-spacer pairs;
determining the effective radius of the frictional area of the disc-plate pairs from the axis about which the clutch rotates; and
calculating the product of said the average coefficient of friction, said number of disc-plate pairs, said effective friction area, and said effective radius.

9. The method of claim 1, further comprising the step of:
establishing a threshold clutch temperature that is higher than the reference clutch temperature;
comparing the calculated clutch temperature and threshold clutch temperature;
and
if the calculated clutch temperature equals or exceeds the threshold clutch temperature, then fully engaging the clutch.

10. (withdrawn) A method for controlling, with the aid of a digital computer, a clutch through which a clutch input and a clutch output are driveably connected, the method comprising the steps of:
inputting to and executing in the computer a computer readable program code algorithm for operating the clutch partially engaged;
providing the computer with a data base including at least a reference clutch temperature;
providing a signal in the computer responsive to the beginning of execution the algorithm;
initializing in the computer in response to the signal a running arithmetic sum;
repetitively calculating in the computer at frequent intervals during execution of the algorithm the change of temperature of the clutch during each interval;
repetitively updating in the computer the running sum with the calculated change of clutch temperature over each interval;
repetitively comparing in the computer at frequent intervals the reference clutch temperature and the magnitude of the running sum; and

if the magnitude of the running sum equals or exceeds the reference clutch temperature, issuing a command from the computer causing an increase in the degree of clutch engagement sufficient to reduce the magnitude of the running sum.

11. (withdrawn) The method of claim 1, wherein the step of issuing a command from the computer further comprises:

terminating execution in the computer of the algorithm; and
issuing a command from the computer causing the clutch to become fully engaged.

12. (withdrawn) The method of claim 11, further comprising the step of:
providing the computer with a data base including the thermal mass of the clutch; and

wherein the step of repetitively calculating the change of temperature of the clutch includes the steps of repetitively calculating in the computer at frequent intervals:

the differential change in power transmitted by the clutch over successive intervals;

determining the thermal mass of the clutch; and

dividing the differential change in power transmitted by the clutch over an interval by the thermal mass of the clutch.

13. (withdrawn) The method of claim 12, wherein the step of repetitively calculating the differential change in power transmitted by the clutch over a time interval includes the steps of repetitively calculating in the computer at frequent intervals:

repetitively calculating in the computer the magnitude of power transmitted to the clutch input over successive intervals;

repetitively calculating in the computer the magnitude of power transmitted from clutch output over successive intervals; and

repetitively calculating of the difference in the magnitude of power at the clutch input and the magnitude of power at the clutch output over each interval.

14. (withdrawn) The method of claim 13, further comprising the steps of: providing the computer with a data base including a clutch gain; and repetitively providing the computer at frequent intervals with input representing a magnitude of pressure at the clutch servo, and a speed of the clutch output; and

wherein the step of repetitively calculating the magnitude of power over an interval at the clutch output includes the step of repetitively calculating in the computer at frequent intervals:

the product of the clutch gain, speed of the clutch output, and the magnitude of pressure at the clutch servo at each interval.

15. (withdrawn) The method of claim 14, further comprising the step of: providing the computer with a data base including the average coefficient of friction of a friction disc-spacer plate pair located in the clutch, the number of said disc-plate pairs, the effective friction area of the disc-spacer pairs, and the effective radius of the frictional area of the disc-plate pairs from the axis about which the clutch rotates; and

wherein the step of repetitively calculating the clutch gain includes the step of calculating the product of said average coefficient of friction, said number of disc-plate pairs, said effective friction area, and said effective radius.

16. (withdrawn) The method of claim 14, further comprising the steps of: providing the computer with a data base including a threshold clutch temperature that is higher than the reference clutch temperature; and further comprising the steps of:

comparing the calculated clutch temperature and threshold clutch temperature; and

if the calculated clutch temperature equals or exceeds the threshold clutch temperature, then fully engaging the clutch.

17. In a transfer case having first and second outputs, a system for controlling a clutch that driveably connects the first output and second output, comprising:

- means for operating the clutch partially engaged;
- means for calculating the temperature of the clutch;
- establishing a reference clutch temperature;
- means for comparing the calculated temperature of the clutch and reference clutch temperature; and
- means for producing an output signal for increasing the degree of clutch engagement sufficiently to reduce the calculated temperature of the clutch, if the calculated temperature of the clutch equals or exceeds the reference clutch temperature.

18. The system of claim 17, wherein the output signal producing means fully engages the clutch if the calculated temperature of the clutch equals or exceeds the reference clutch temperature.

19. The system of claim 17, further comprising:
a fluid pressure source;
a servo through which the clutch is alternately pressurized and vented to engage and disengage the clutch; and
a solenoid communicating with the output producing means for increasing a magnitude of pressure in the servo in responsive the output signal.

20. (withdrawn) In a vehicle drive line having an engine controlled by a throttle position, a method for controlling a clutch that driveably connects an input and an output with varying degrees of clutch engagement, the method comprising the steps of:

operating the clutch partially engaged;
determining a current throttle position, throttle rate, and vehicle speed;
determining a first desired clutch engagement corresponding to the current
throttle position and vehicle speed;
determining a second desired clutch engagement corresponding to the current
throttle rate and vehicle speed; and
changing the degree of clutch engagement to the greater of the first desired
clutch engagement and the second desired clutch engagement.

21. (withdrawn) The method of claim 20, further comprising:
determining a length of a first period that begins upon initiating partial
engagement of the clutch;
reducing the first desired clutch engagement by a factor whose magnitude
varies inversely with the length of the first period; and
changing the degree of clutch engagement to the greater of the first desired
clutch engagement and the second desired clutch engagement.

22. (withdrawn) The method of claim 21, further comprising:
maintaining the first desired clutch engagement for a second period of
predetermined length.

23. (withdrawn) The method of claim 20, further comprising:
determining a reference clutch engagement;
determining a difference between the second desired clutch engagement and
the reference clutch engagement;
reducing the second desired clutch engagement by a magnitude that varies
directly with said difference; and
changing the degree of clutch engagement to the greater of the first desired
clutch engagement and second desired clutch engagement.

24. (withdrawn) The method of claim 20, wherein the step of reducing the second desired clutch engagement further comprises:

subtracting from the second desired clutch engagement a magnitude that decreases as the magnitude of said difference decreases.

25. (withdrawn) The method of claim 20, wherein the step of operating the clutch in a partially engaged condition includes the steps of:

determining a current clutch slip;

establishing a first desired portion of the input torque to be transmitted by the clutch to the second output;

determining a first magnitude of clutch torque corresponding to the first desired portion;

determining a second magnitude of clutch torque to be transmitted to the second output in proportion to the current clutch slip; and

changing the magnitude of torque transmitted by the clutch to the sum of the first and second magnitudes.

26. (withdrawn) The method of claim 20, wherein the step of increasing the degree of clutch engagement over a period sufficient to reduce the calculated temperature of the clutch includes the step of fully engaging the clutch.

27. (withdrawn) In a transfer case, driveably connected to an engine controlled by throttle, a system for controlling a clutch that driveably connects the first output and second output with varying degrees of clutch engagement, comprising:

means for operating the clutch partially engaged;

means for determining a current throttle position, throttle rate and vehicle speed;

means for determining a first desired clutch engagement corresponding to the current throttle position and the current vehicle speed;

means for determining a second desired clutch engagement corresponding to the current throttle rate and the current vehicle speed;

means for producing a command clutch duty cycle signal representing the greater of the first desired clutch engagement and the second desired clutch engagement, whereby the degree of clutch engagement is changed in response to the command signal.

28. (withdrawn) The system of claim 27, further comprising:
- means for determining a reference clutch engagement;
 - means for determining a difference between the second desired clutch engagement and the reference clutch engagement;
 - means for reducing the second desired clutch engagement by a magnitude that varies directly with said difference; and
 - a valve operated by a solenoid for opening communication between the pressure source and the servo in response to the clutch duty cycle command signal applied to the solenoid.

29. (withdrawn) The system of claim 27, further comprising:
- means for determining a length of a first period that begins upon initiating partial engagement of the clutch;
 - means for the first desired clutch engagement by a factor whose magnitude varies inversely with the length of the first period; and
 - means for changing the degree of clutch engagement to the greater of the first desired clutch engagement and the second desired clutch engagement.

30. (withdrawn) The system of claim 27, further comprising:
- means for maintaining the first desired clutch engagement for a second period of predetermined length.

31. (withdrawn) The method of claim 27, further comprising:
- means for determining a reference clutch engagement;
 - means for determining a difference between the second desired clutch engagement and the reference clutch engagement;
 - means for reducing the second desired clutch engagement by a magnitude that varies directly with said difference; and

means for changing the degree of clutch engagement to the greater of the first desired clutch engagement and second desired clutch engagement.

32. (withdrawn) The method of claim 27, wherein the step of reducing the second desired clutch engagement further comprises:

subtracting from the second desired clutch engagement a magnitude that decreases as the magnitude of said difference decreases.

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(ix) Evidence Appendix

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No evidence was submitted pursuant to 37 CFR 1.130, 1.131 or 1.132, nor was any other evidence entered by the examiner and relied on by applicants in the appeal.

(x) Related Proceeding Appendix

No decision was rendered by a court or the Board in any proceeding related to appeals and interferences related to this application.

Respectfully submitted,
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